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(54) **SELF-ADJUSTED SUPPLY AIR TERMINAL**

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F24F 13/14 (2006.01)

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CPC ***F24F 13/1413*** (2013.01); ***F24F 13/06*** (2013.01); *F24F 2221/14* (2013.01)

(58) **Field of Classification Search**
USPC 454/349, 353, 359, 360, 304; 137/527.6
See application file for complete search history.

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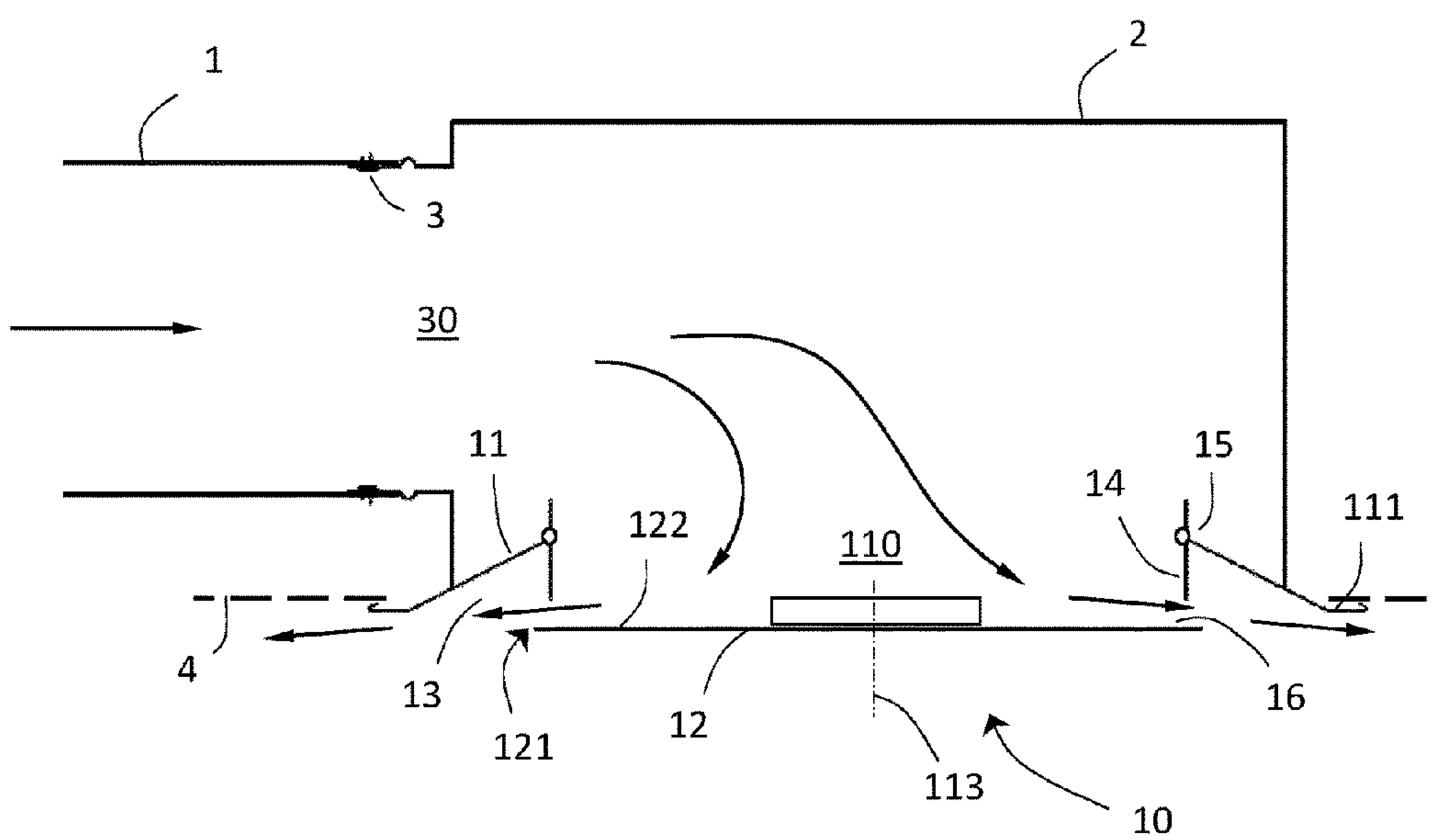
(57) **ABSTRACT**

A supply air terminal (**10**) is provided, comprising a wall member (**11**) surrounding an opening (**110**); a deflector (**12**) connected at a distance from the wall member to face the opening, thereby forming an annular aperture (**13**) between the wall member and the deflector; and a plurality of flaps (**14**) pivotably connected at a hinge (**15**) to the wall member to hang down in the annular aperture such that an open slit (**16**) is formed between an edge (**142**) of each flap and the deflector, wherein the slit has a width which is self-adjusted by means of the flaps pivoting under influence of the airflow through the terminal.

15 Claims, 5 Drawing Sheets



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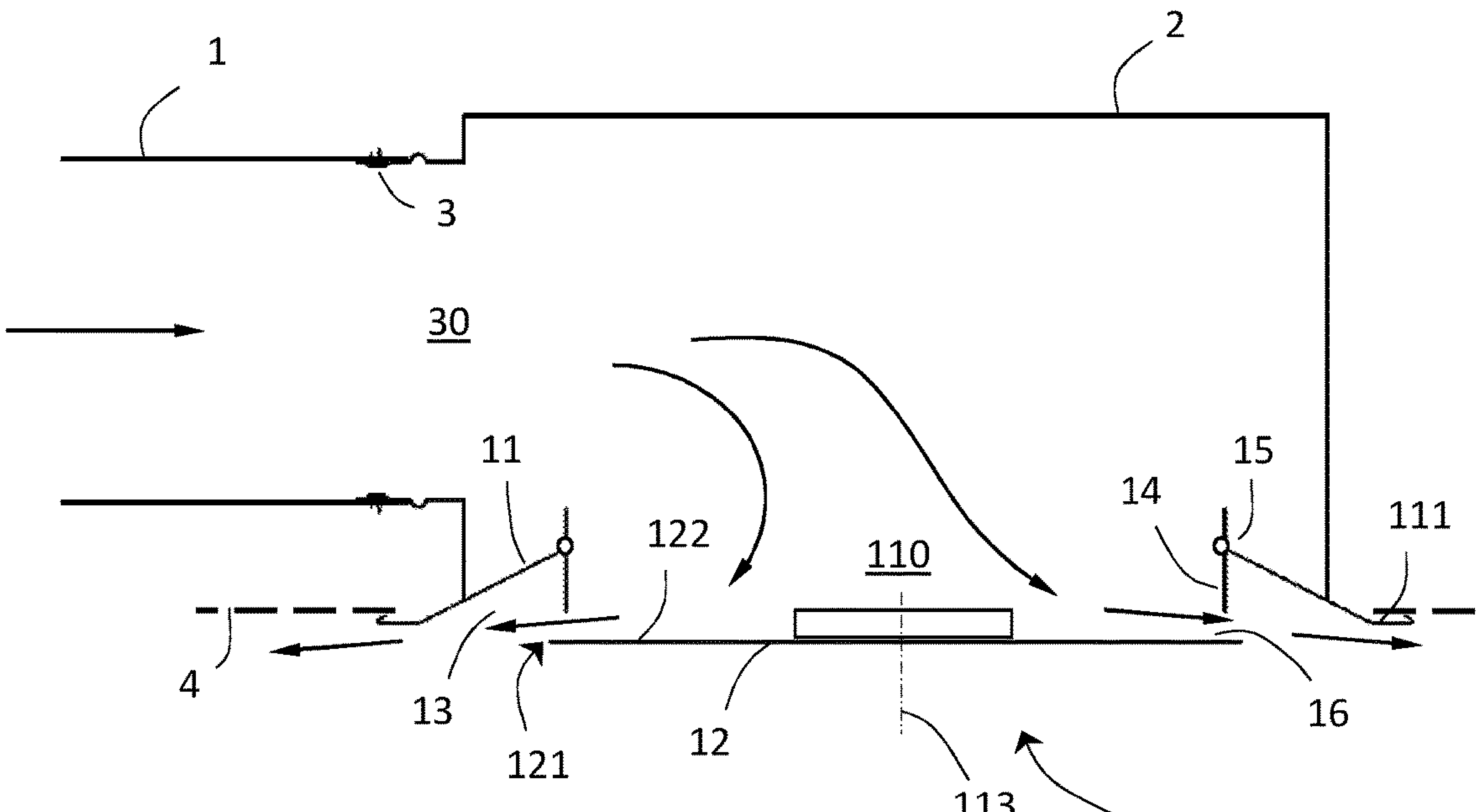

Fig. 1

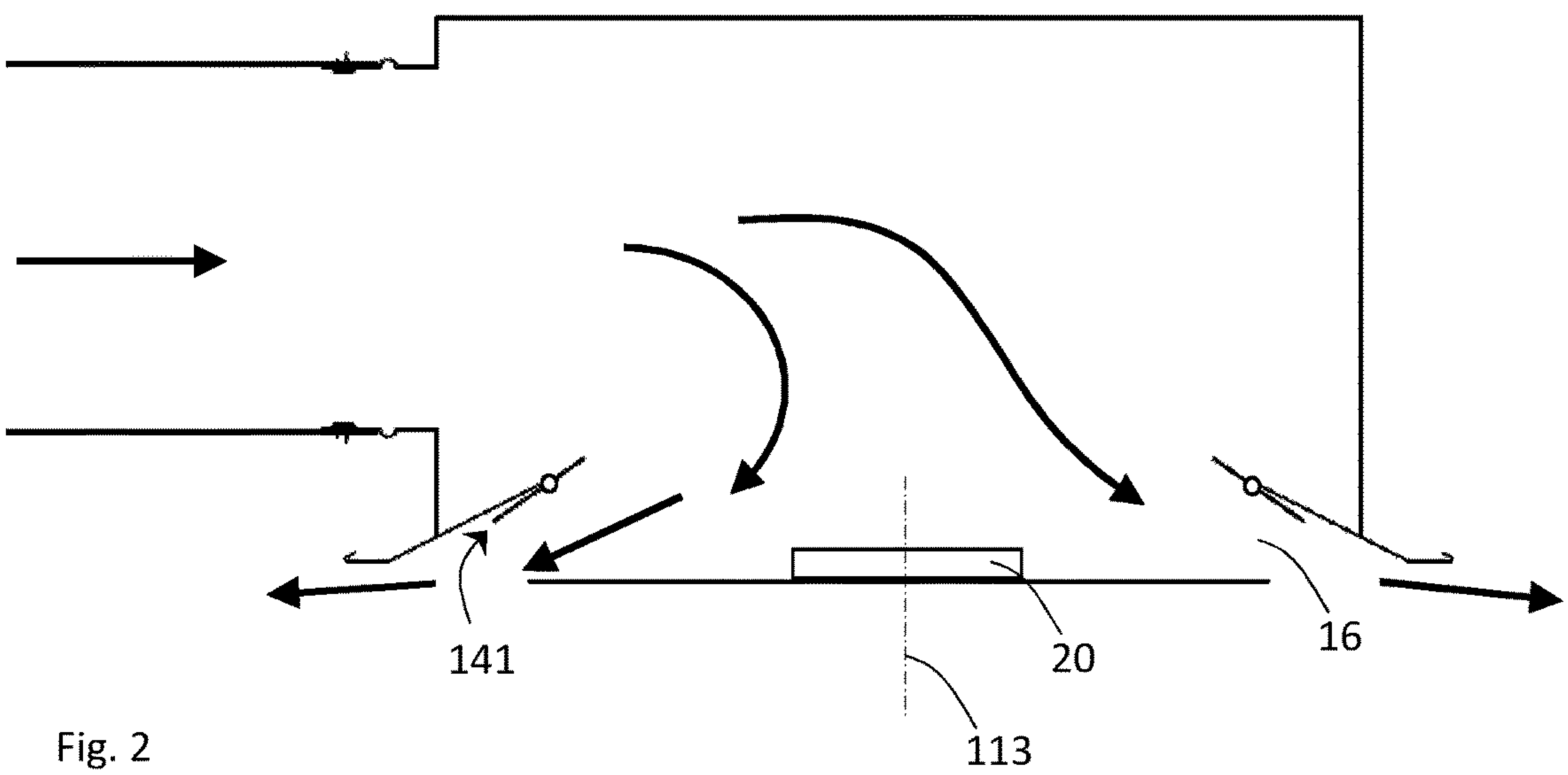

Fig. 2

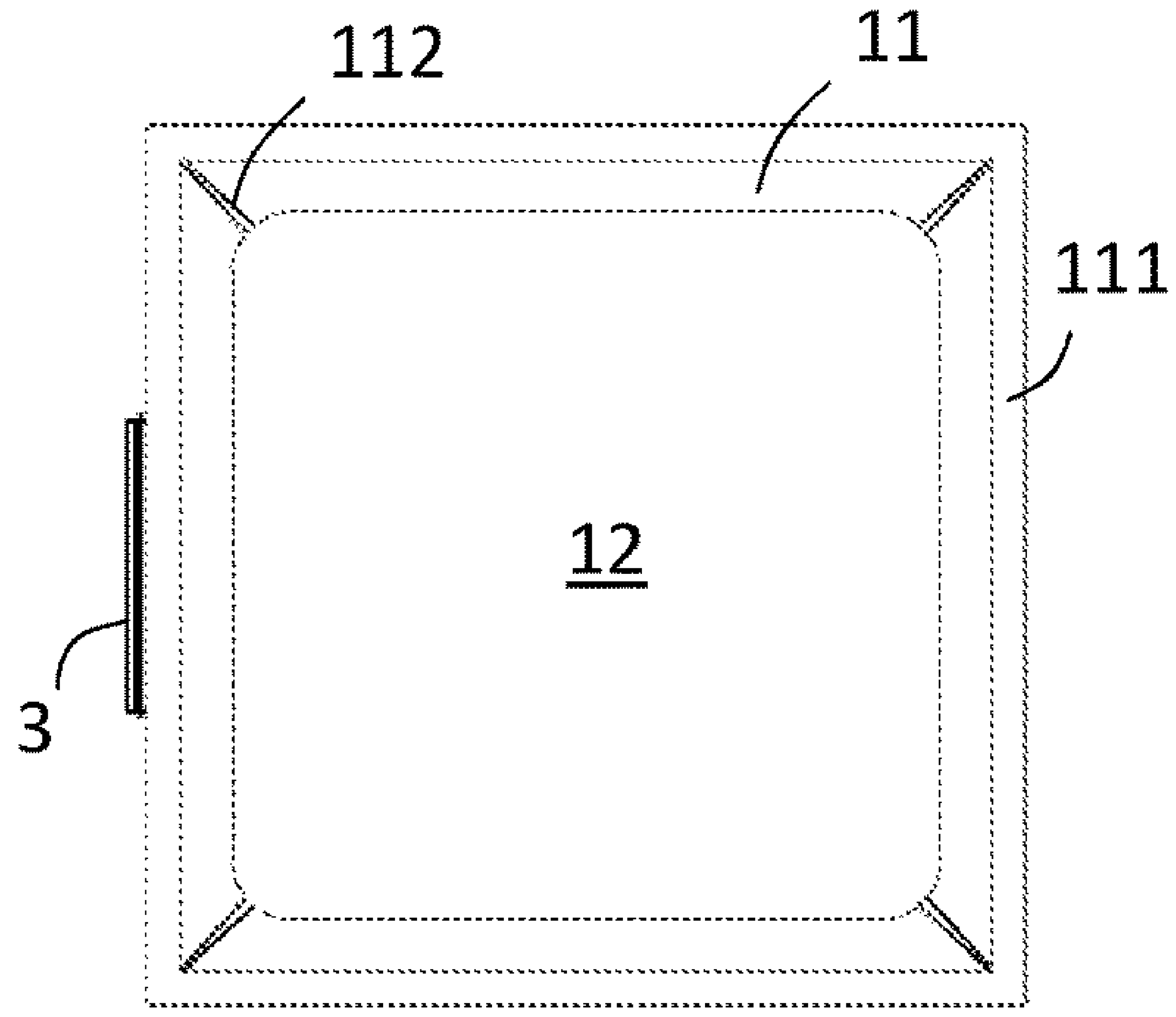

Fig. 3A

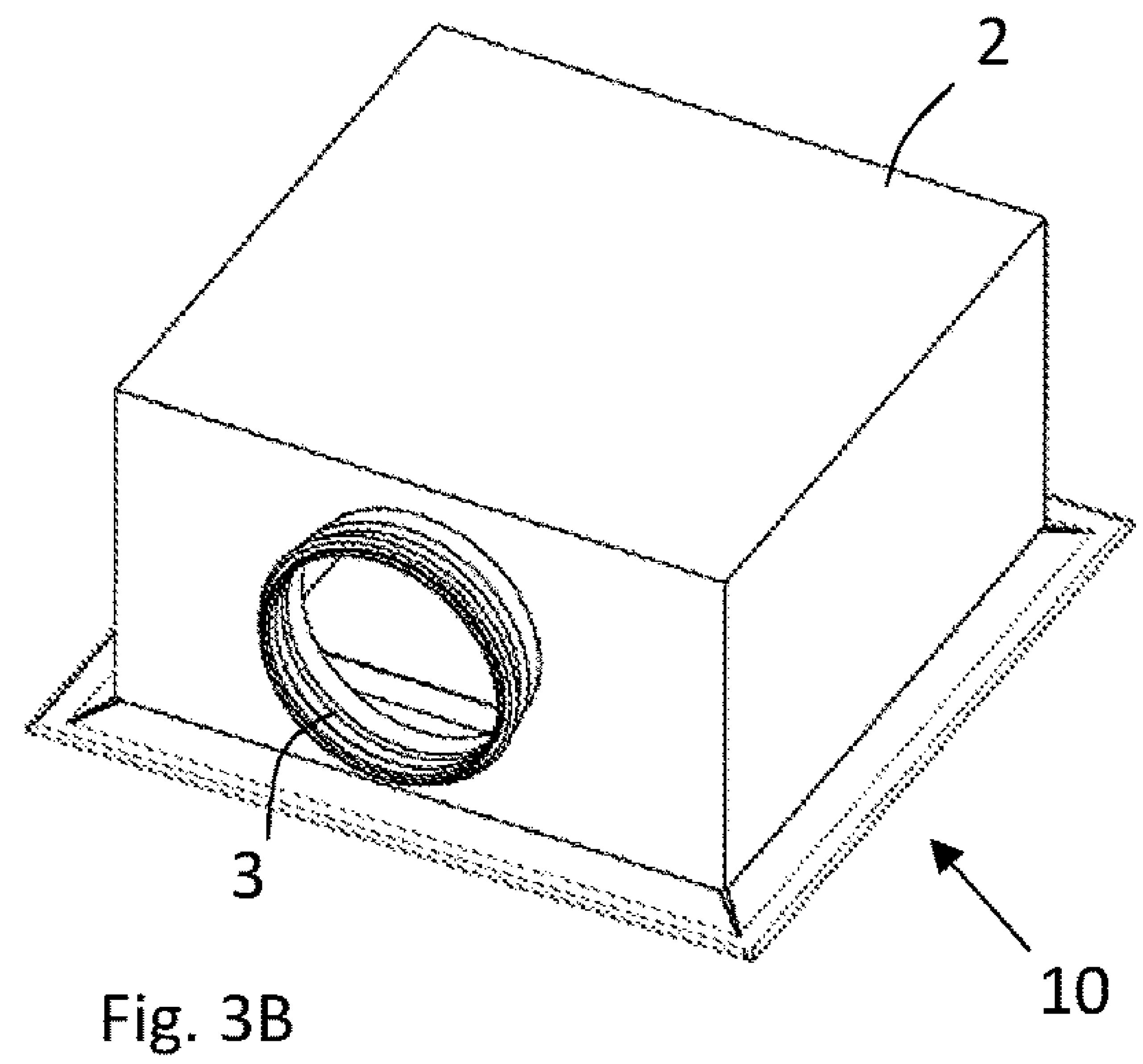

Fig. 3B

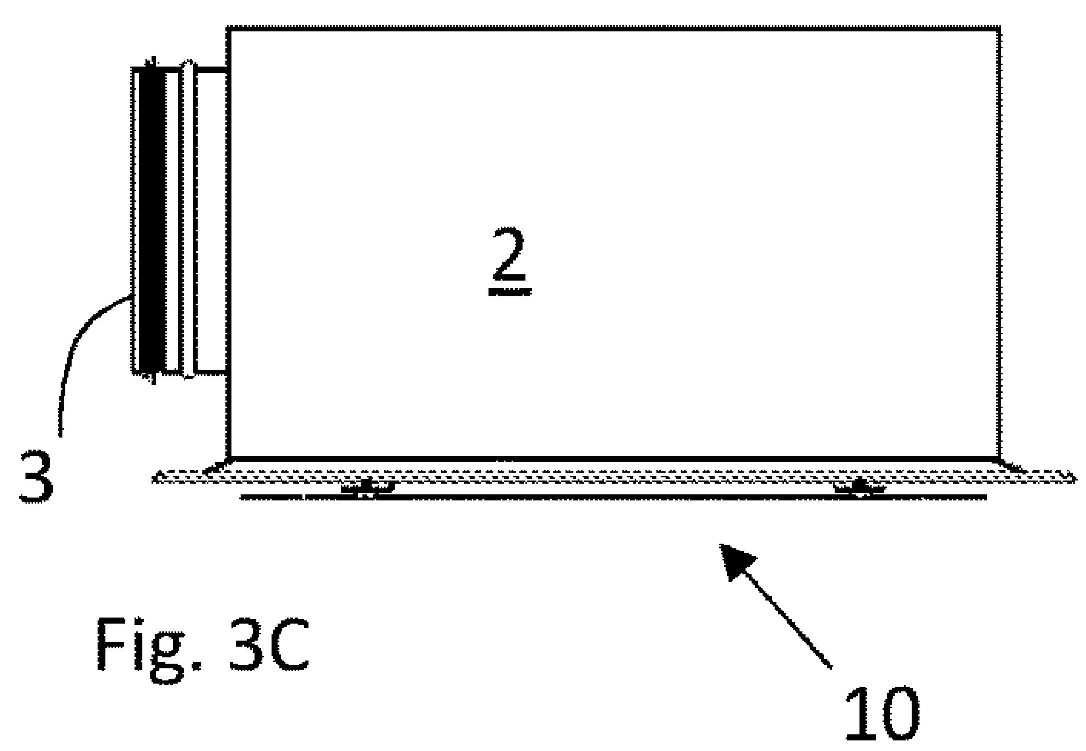

Fig. 3C

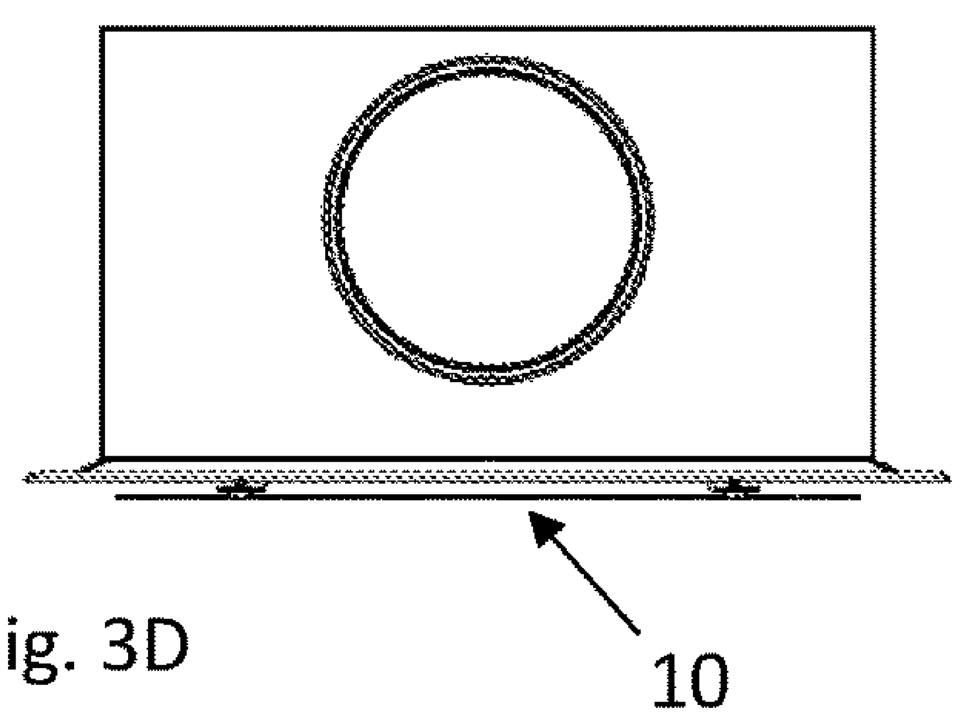

Fig. 3D

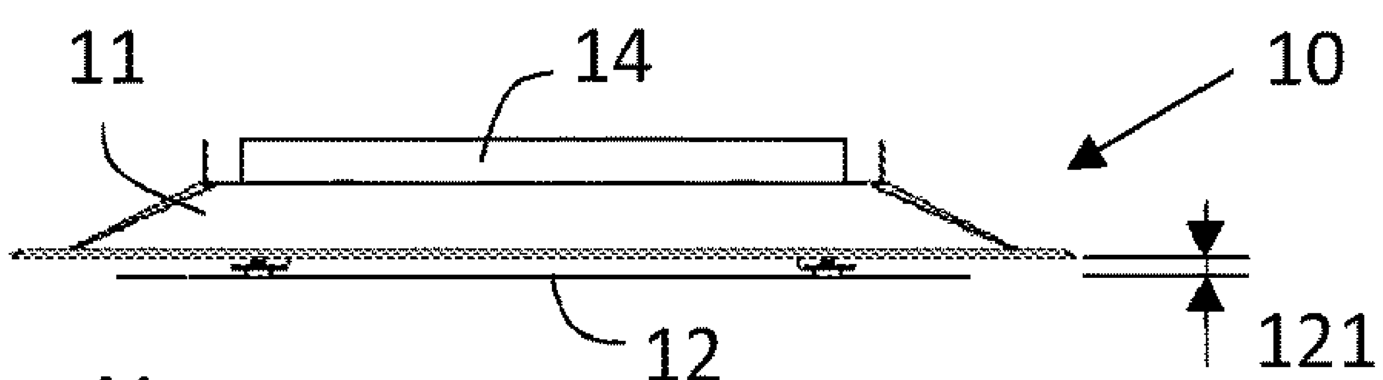

Fig. 4A

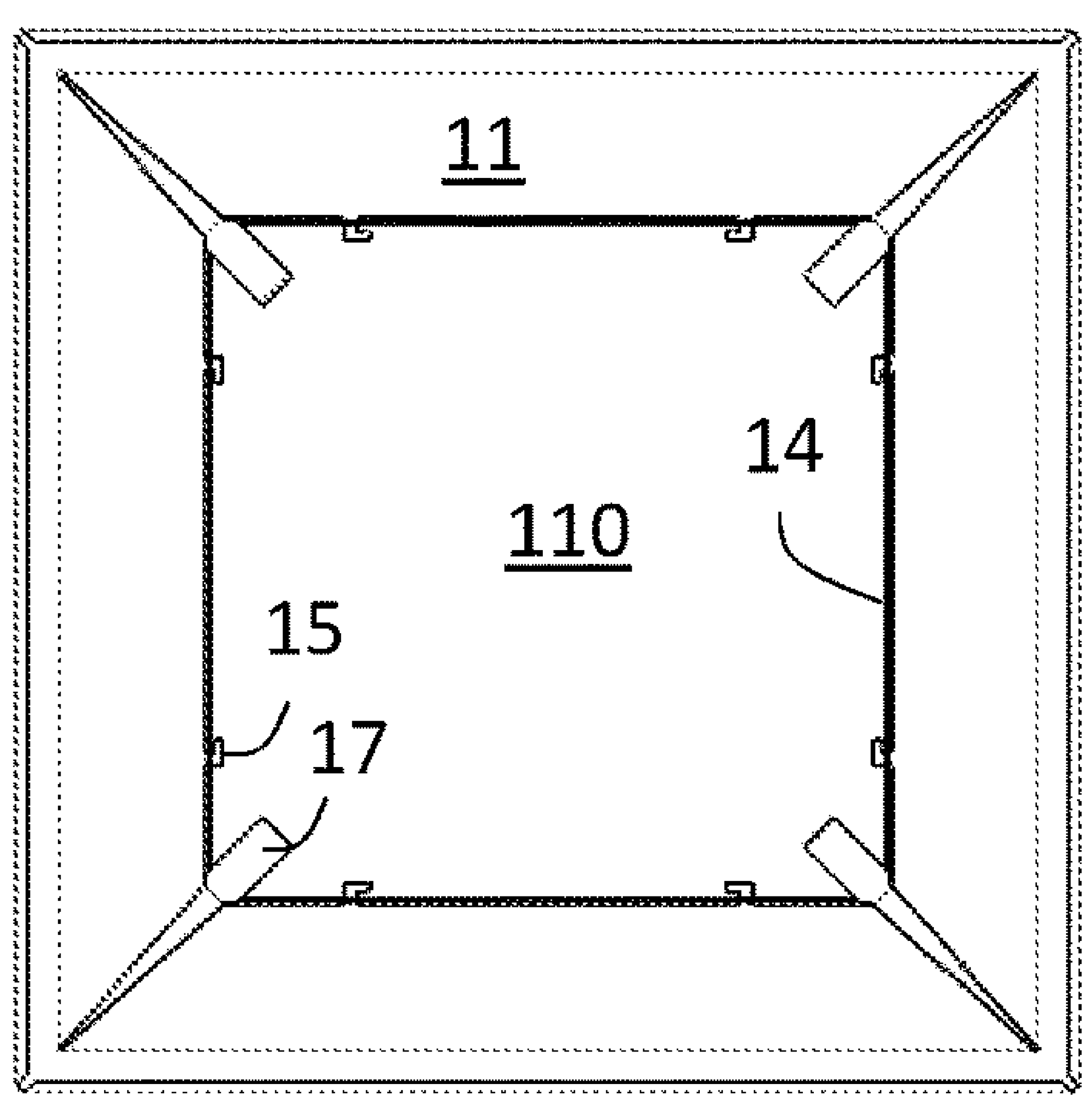

Fig. 4B

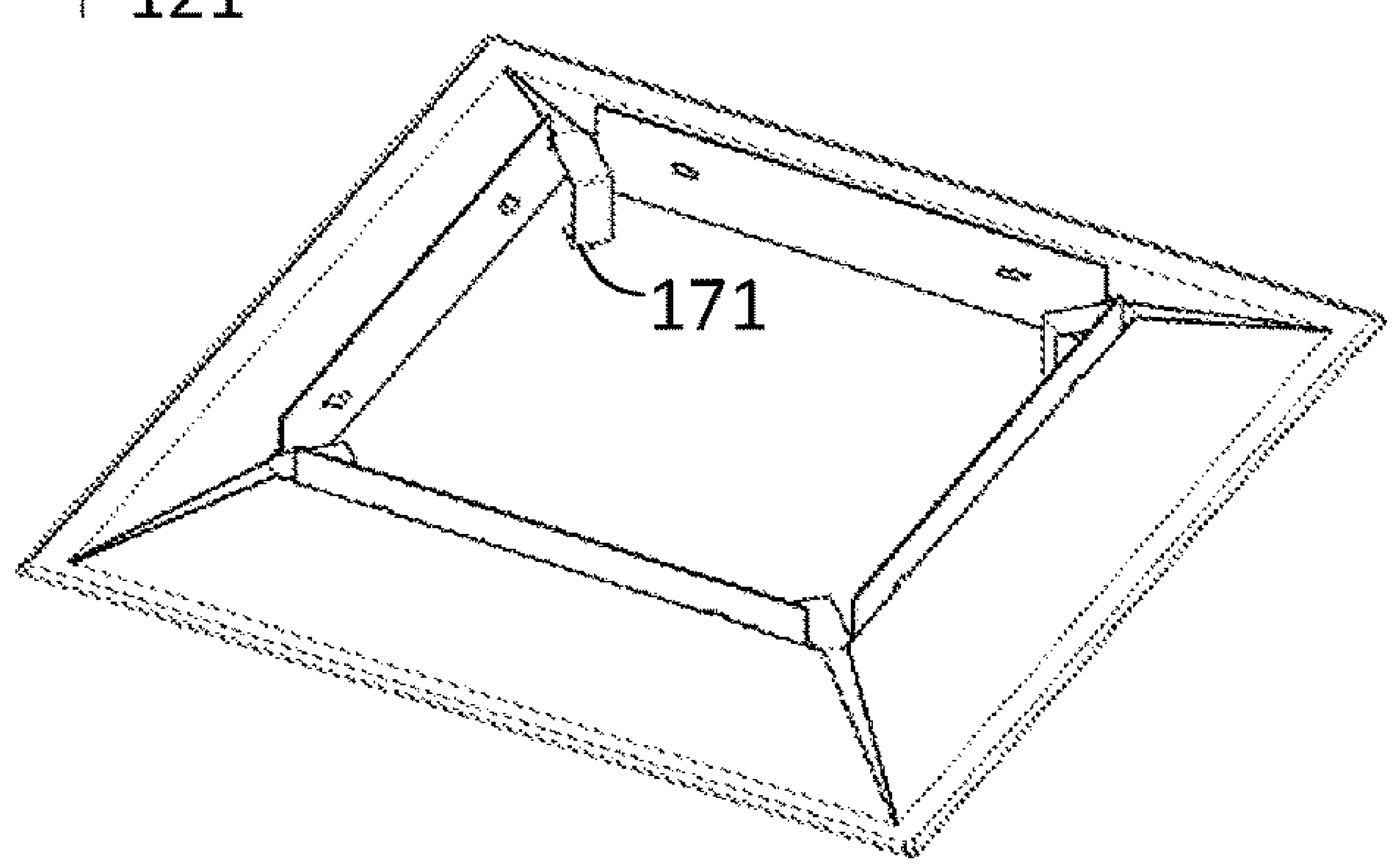

Fig. 4C

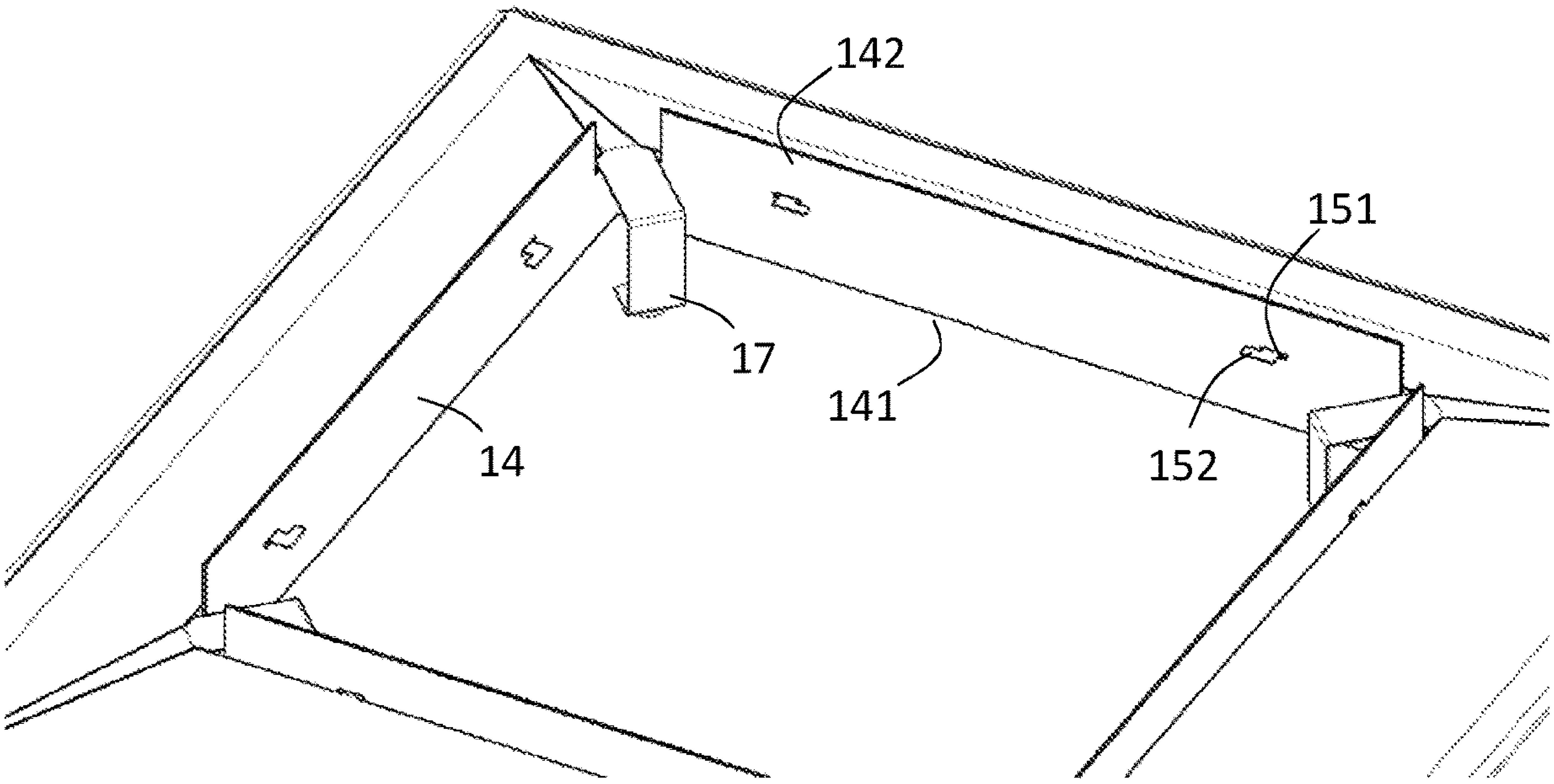

Fig. 5A

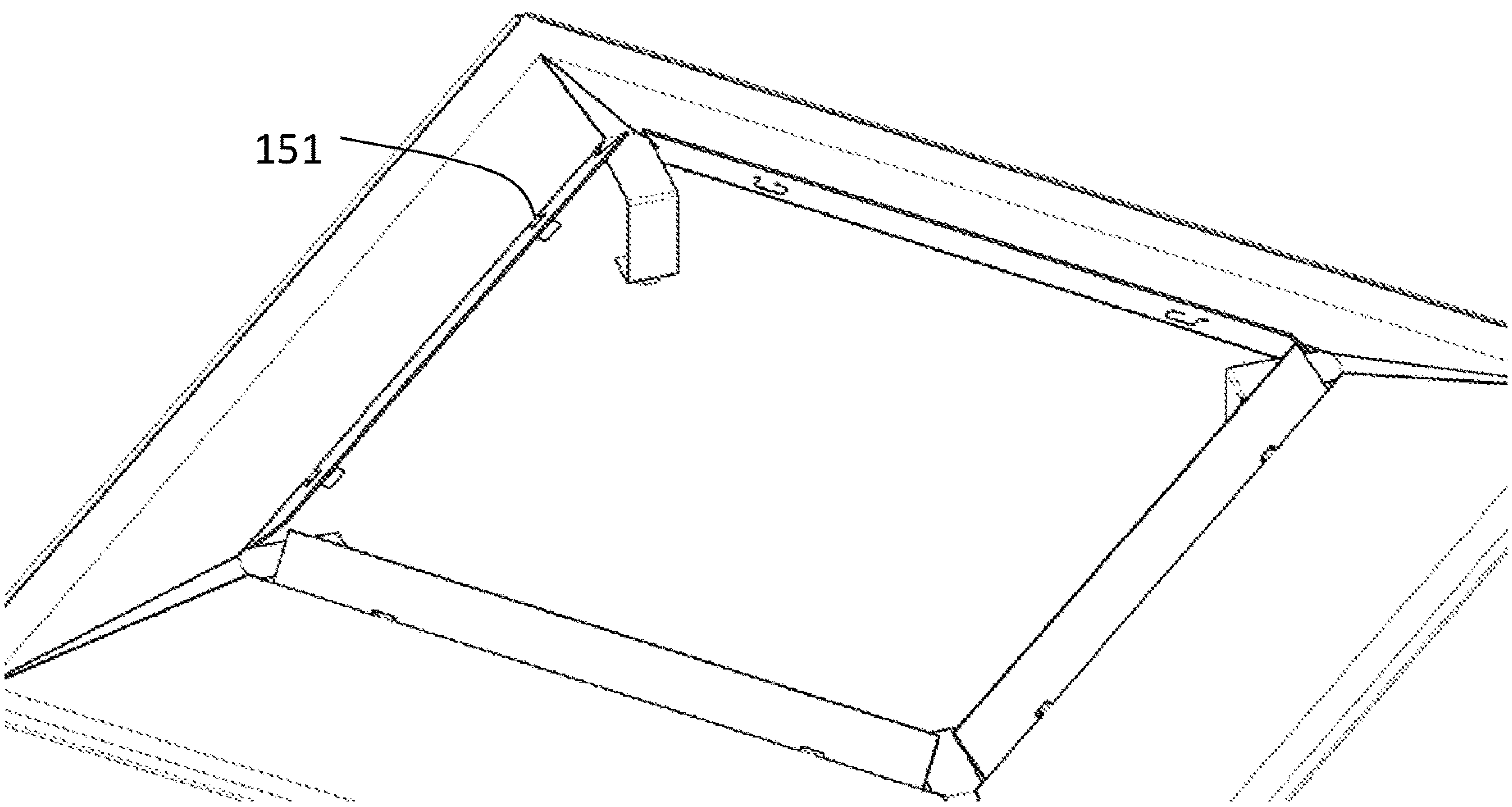

Fig. 5B

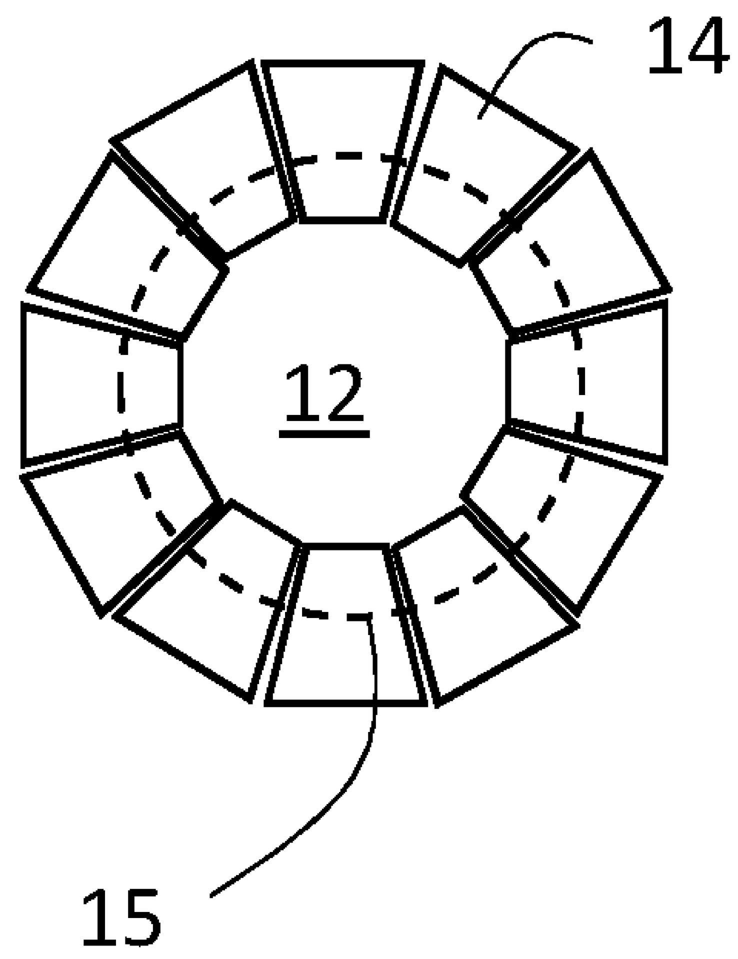

Fig. 6

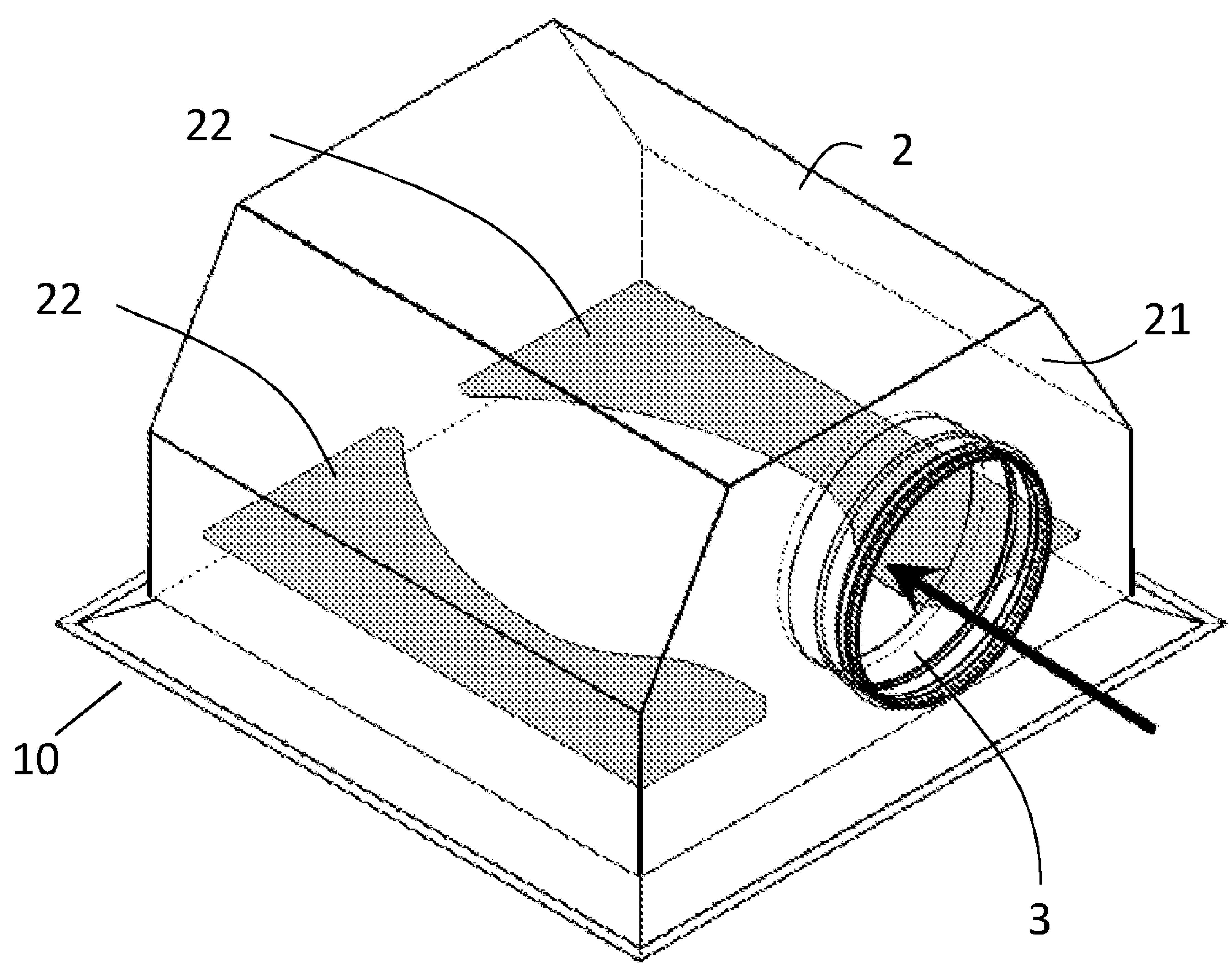

Fig. 7

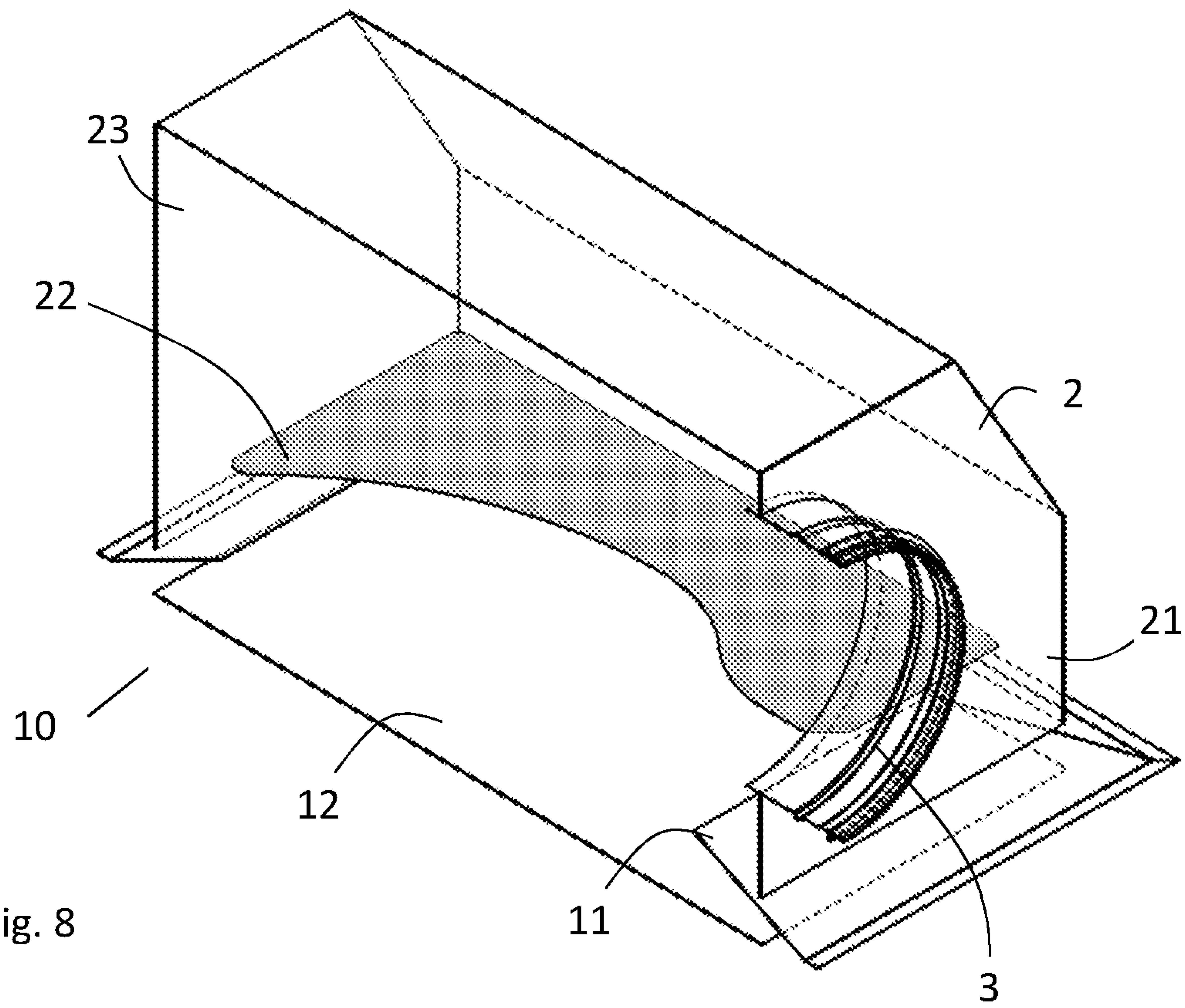

Fig. 8

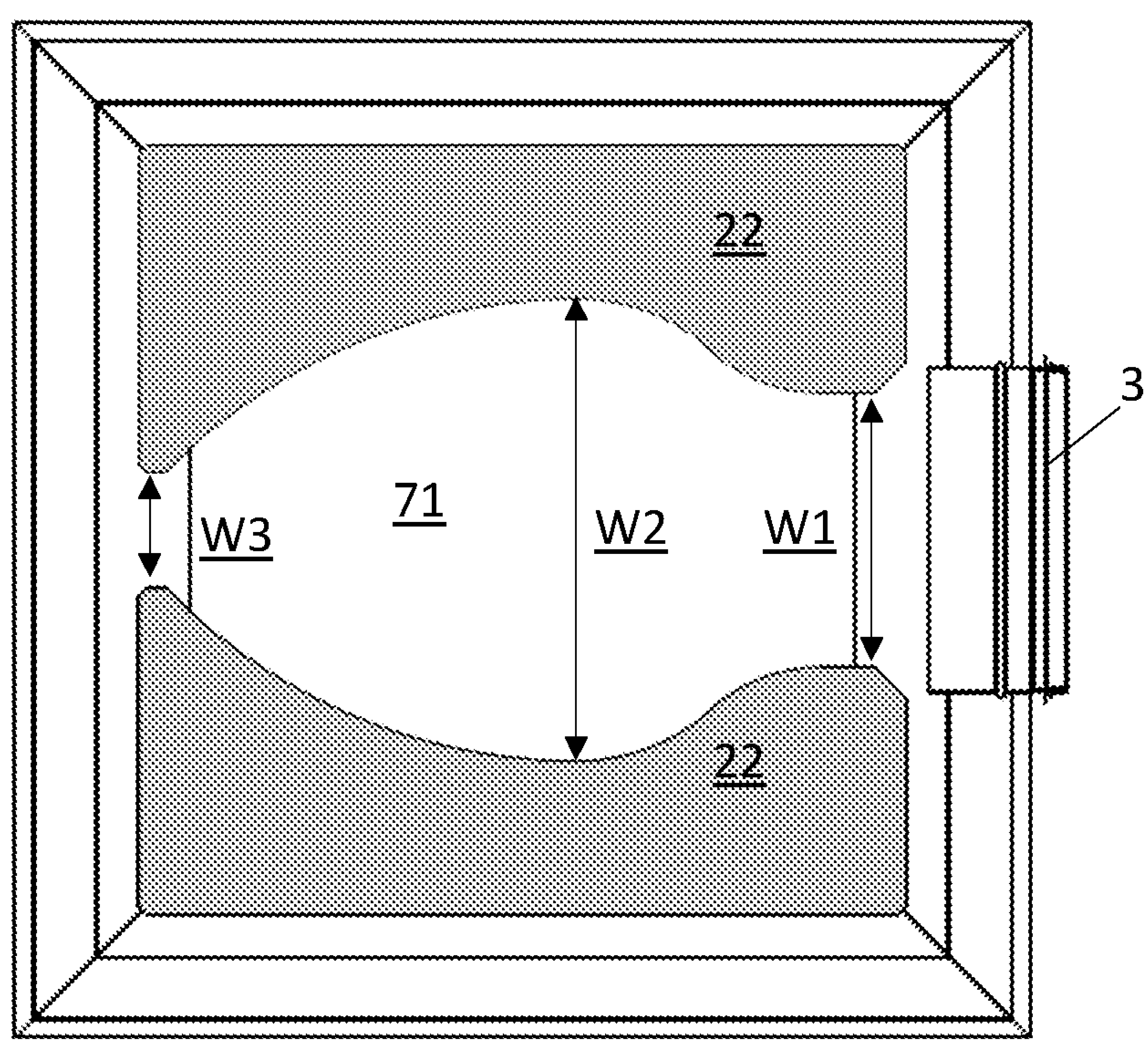

Fig. 9

SELF-ADJUSTED SUPPLY AIR TERMINAL

PRIORITY CLAIM

This application is a 35. U.S.C. § 371 national phase of PCT/SE2018/050226 filed Mar. 9, 2018; which application claims priority from European Application No. 17161972.9 filed Mar. 21, 2019. The above-referenced applications are hereby incorporated by reference in their entireties as if fully set forth herein.

TECHNICAL FIELD

The invention relates to the field of devices for distribution of airflows. More specifically, the invention pertains to the field of supply air terminals for distribution of air in different types of spaces, configured so as to provide a suitable velocity of distributed air, when the air is supplied to the terminal at various different flows, such that the distributed air mix suitably with the existing atmosphere in the room or space in question.

BACKGROUND

Ventilation and provision of airflows of variable degree may be employed in any type of building space, such as in a home environment. More notably, the requirements for suitable ventilation are particularly relevant for public buildings and commercial spaces, where there occasionally may be many people, and in other types of spaces where requirements for e.g. temperature, humidity, oxygen level etc. may be important.

In order to save energy in large commercial and public buildings, ventilation systems with variable airflow may be employed, which operate with cooled air of e.g. 15-18 degrees Celsius. Savings are obtained by heating of the air inside the room to which the airflow is provided, by means of people, lighting, computers and other electronic devices and even animals present therein.

An important feature is that the supply air is conveniently spread in the room without causing draught, which could be experienced as uncomfortable and potentially damaging. One way of obtaining this is to provide air from an air terminal, such that cooled fresh air is propelled along the ceiling of a room. This way, hotter air already present in the room will be pulled up by the airflow and be purposefully mixed with the cooled fresh air already within a short distance from the terminal.

General requirements on an air terminal is a low level of noise generation, as caused by flowing air. Furthermore, the air terminal must in many applications be able to operate with very low flows, such as 5-40 l/s (liters per second). During the winter season in countries where the climate provides temperatures that are way below normal room temperature, air may oftentimes be supplied within low ranges of e.g. 10-20 l/s, due to the additional cooling of the room through walls and windows.

Presently, supply air terminals with a fixed opening dominate the market, due to lower cost for manufacturing than terminals with a controllably regulated opening. Such terminals are most often configured with opening dimensioned to provide a low level of noise at high flows. As a consequence, there may often be problems with draught, by means of dropping cold air, at low flows. At any rate, a supply air terminal with a fix opening will generally work far from optimally at either high flows or low flows.

WO02/35157 presented a solution for an air terminal with a controlled valve function for variable flows, comprising a tube with an output opening and a deflector surface facing the output opening for regulation of the air flow by means of an actuator for variable setting of the distance between the deflector surface the output end. The device was further provided with discs in the output opening, forming separate fluid passages arranged in parallel to each other with a narrow width over an extended flow distance to promote laminar flow with low noise generation.

WO03/001124 provided a combined fire damper and air terminal, with a shutter that opens a gap progressively as the flow increases, for the purpose of avoiding cold zones. The presented solution is not suitable for operation at high flows, though, as it will generate a high level of noise by design, and an unsatisfactory ejection of air along the ceiling.

U.S. Pat. No. 4,508,022 disclosed a ceiling air outlet, which has at least two flow paths before an outlet grate. One comprises a series of jet openings at a peripheral portion of the device, directed toward the outlet grate, providing a flow path for low level airflow. A second flow path is provided radially inwardly of the jet openings, where an adjustment flap is located which is configured to open up to allow for air passage at higher flows. The device is characterized by its complexity in terms of design and manufacture.

WO2015/189992 suggests a ceiling cassette air conditioner which includes an external case attached to a lower side of a ceiling-embedded casing, and forming an air inlet with the ceiling, an external panel attached to a lower side of the external case, having an air blower and a heat exchanger inside, and forming an air outlet with the external case to discharge conditioned air in a ceiling-parallel direction. The device includes wind direction adjusting vanes provided on an outer periphery of the external panel to adjust a discharge direction of the conditioned air discharged from the air outlet. During operation, the wind direction adjusting vanes are turned in a clockwise and counterclockwise direction from a reference position by means of a drive source such as a motor.

DE4010134 discloses an air supply unit for air conditioning of rooms, having a distributor housing for mounting in the ceiling. On the underside of this housing are one or more lateral primary air nozzles and also a central air outlet with an air-deflector body. The primary nozzles may be adjustable, while the body can be of the swirl-inducing type, mounted in a vertical guide tube, and adjustment may typically be accomplished by means of a servo motor.

None of these devices offer a solution suitable for regulation of air distribution to different spaces which is compatible with existing ventilation installations. More specifically, there is still exists a need for a device for controlled distribution of air which is both cost-effective and capable of regulating air distribution at various air flows, which may be both high and low flow levels supplied from a ventilation system, such that suitable mixing with the surrounding air is obtained.

SUMMARY

In order to target the drawbacks and objectives of the state of the art, a supply air terminal according to claim **1** is provided.

According to one aspect, this relates to a supply air terminal, comprising a wall member surrounding an opening; a deflector connected at a distance from the wall member to face the opening, thereby forming an annular aperture between the wall member and the deflector; a plurality of flaps pivotably connected at a hinge to the wall member to hang down in the annular aperture such that an open slit is formed between an edge of each flap and the deflector, wherein the slit has a width which is self-adjusted by means of the flaps pivoting under influence of the airflow through the terminal.

In one embodiment, said flaps are pivotable between a relaxed position and a high flow position, wherein the flap edges are arranged radially inwardly of a perimeter of the deflector and at a first distance from the deflector in at least the relaxed position.

In one embodiment, the flap edges are arranged radially outwardly of the perimeter of the deflector in the high flow position.

In one embodiment, an outwards projecting flange is formed at an outer end of the wall member, which flange extends in a plane about the opening.

In one embodiment, wherein an outer portion of the deflector is parallel to, and spaced apart outwardly of, the projecting flange.

In one embodiment, the opening formed by the wall member has a cross-section which increases from a position of said hinge towards said projecting flange.

In one embodiment, each flap has a balancing portion for calibrating the position of center of gravity for the flap with respect to the position of the hinge.

In one embodiment, said hinge comprises an aperture formed in the flap and a hinge member projecting from the wall member into the aperture, such that the flaps rests with an edge of the aperture against the projecting hinge member.

In one embodiment, said hinge member is a bent portion extending from the wall member.

In one embodiment, the wall member and the flange are formed from a single sheet of metal.

In one embodiment, said hinge member is formed from said single sheet of metal.

In one embodiment, said wall member has two pairs of opposing wall sides, providing a rectangular shape to the opening, the terminal comprising four flaps hinged to respective wall sides.

In one embodiment, said wall member has a cylindrical wall side, providing a circular shape to the opening, the terminal comprising three or more flaps hinged to the wall side at evenly distributed positions around the opening.

In one embodiment, said deflector is a flat sheet, detachably connectable to the wall member.

In one embodiment, each flap is made from a flat sheet of plastic.

BRIEF DESCRIPTION OF THE DRAWINGS

Various aspects associated with the invention will be described below with reference to the accompanying drawings, on which

FIG. **1** schematically illustrates a cross-sectional view an embodiment of an air supply terminal for ceiling mounting, self-adjusted for low level airflow;

FIG. **2** schematically illustrates the embodiment of FIG. **1**, self-adjusted for high level airflow;

FIG. **3** illustrates various views of an embodiment of an air supply terminal connected to an air supply chamber, for connection to an air supply duct;

FIG. **4** illustrates various views of an embodiment of an air supply terminal applicable to the embodiments of FIGS. **1**-**3**;

FIG. **5** illustrates perspective views of the air supply terminal of FIG. **4**, as adjusted for different flow levels;

FIG. **6** schematically illustrates an arrangement of flaps in an embodiment of an air supply terminal configured with a circular cross-section;

FIG. **7** schematically illustrates a supply air system comprising a sealed box having an outlet opening connected to a supply air terminal according to one embodiment;

FIG. **8** illustrates a part of the embodiment of FIG. **7** in cross-section; and

FIG. **9** illustrates the supply air system of FIG. **7** from a side opposite the outlet opening connecting to the supply air terminal.

DETAILED DESCRIPTION OF EMBODIMENTS

The invention will now be described more fully hereinafter with reference to the accompanying drawings, in which embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art.

It will be understood that, when an element is referred to as being "connected" to another element, it can be directly connected to the other element or intervening elements may be present. In contrast, when an element is referred to as being "directly connected" to another element, there are no intervening elements present. Like numbers refer to like elements throughout. Well-known functions or constructions may not be described in detail for brevity and/or clarity. Unless otherwise defined, all terms, including technical and scientific terms, used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs.

Embodiments of the invention are described herein with reference to schematic illustrations of idealized embodiments of the invention. As such, variations from the shapes and relative sizes of the illustrations as a result, for example, of manufacturing techniques and/or tolerances, are to be expected. Thus, embodiments of the invention should not be construed as limited to the particular shapes and relative sizes of regions illustrated herein but are to include deviations in shapes and/or relative sizes that result, for example, from different operational constraints and/or from manufacturing constraints. Thus, the elements illustrated in the figures are schematic in nature and their shapes are not intended to illustrate the actual shape of a region of a device and are not intended to limit the scope of the invention.

The general composition and function of an embodiment of the supply air terminal **10**, also referred to as just terminal **10** for short herein, will now be described with reference to FIGS. **1**-**4**.

FIG. **1** presents an implementation of air supply terminal according to an embodiment, assembled in connection with ventilation system. The air supply terminal as presented herein by means of embodiments is not configured for control of the flow level of air in itself. Rather, the function of the supply air terminal is to provide suitable provision of air to a connecting room dependent on the airflow level provided to the terminal. FIG. **1** illustrates a supply duct **1** of a ventilation system, connected to a box **2** at an interface **3**. Normally, the box **2** is provided just above the inner ceiling **4** of a room, as are at least parts of the supply ducts **1**. The box **2** has an opening at its lower side for connection to a supply air terminal **10**, and is preferably otherwise sealed. A valve device for regulation of the airflow (not shown) may be arranged in the box **2**, for regulating the airflow provided to the terminal **10**. Alternatively, a device for regulating the airflow may be provided upstream in the duct **1** or farther away.

FIG. **2** illustrates the same embodiment as in FIG. **1**, but in a setting for a different airflow level, as will be described. For the purpose of minimizing the cluttering of the drawings, some reference numerals are provided in FIG. **1** and some in FIG. **2**, but they shall be understood as referring to the corresponding elements in any of these two drawings. In fact, the same reference numerals are used throughout the drawings to indicate the same or corresponding elements and features, for the sake of simplicity. FIG. **3** shows various perspective views of the terminal **10** assembled with a box **2**, also indicating the interface **3** for mounting to a ventilation duct.

FIG. **4**A illustrates a top view of the terminal **10**, as seen from side of the box **2**, and FIG. **4**C shows the terminal **10** from a perspective view.

As can be seen in these drawings, the supply air terminal **10** comprises a wall member **11** which surrounds an opening **110**. The opening **110** represents the output opening of the box **2**, when the terminal is assembled to such a box **2**. A deflector **12** is connected at a distance **121** from the wall member **11** to face the opening **110**. Preferably, the deflector is arranged perpendicular to an axis **113** of the opening **110**. An annular aperture **13** between the wall member **11** and the deflector **12** is thus formed, through which air may be supplied. The deflector **12** is preferably connected at a fixed distance from the wall member **11**, but may be detachable by suitable means, as will be described.

The terminal **10** further comprises two or more flaps **14**, which are pivotably connected to the wall member **11** by means of a hinge **15**. The hinge **15** is schematically represented in FIGS. **1** and **2** by a small ring, but may be embodied on different ways, with examples being presented further below. The flaps are preferably freely suspended in the respective hinge **15** at a distance from the point of gravity for the flaps, so as to hang down by the force of gravity. When the terminal **10** is arranged with the deflector **12** substantially horizontally, such as when the terminal **10** is provided in a ceiling **4** arrangement, the flaps **14** may hang down towards the deflector **12** in the annular aperture **13**, such that an open slit **16** is formed between an edge **142** of each flap **14** and the deflector **12**. This is illustrated in FIG. **1** for a low airflow, or no airflow at all. In various embodiments, the terminal may be configured such that the flaps will hang down at low flow levels, e.g. up to 25 or 40 l/s. Such configuration or calibration may be determined on inter alia the weight of the respective flap, the position of the point of balance of the flaps in the hinges **15**. So, in this rested arrangement, the flaps are arranged in their edges **141** in the most proximal position to the deflector, but they are not configured to close the aperture **13**. Rather, a minimum slit opening **16** is defined by the length of the flap **14** from the hinge **15** to the edge **141**, in relation to the position of the deflector with respect to the position of the hinge. The size of the minimum slit opening **16** may be in the range of 1-20 mm, e.g. in the range of 1-10 mm, 5-10 mm, 5-20 mm, or other. The size of the slit **16** may be selected dependent on inter alia the range of airflow level the terminal is deployed to provide in the particular ventilation installation, and the overall size of the aperture **13** as determined by its circumference. In one embodiment, the setting of the minimum slit opening **16** is accomplished by selection of a predetermined size of flap, which is suspended at the hinge **15** to a wall member **11** which is used for all installations of a particular dimension. This way, terminals **10** may be provided for a wide variety of operating conditions, with a major part of the installation members being used in common. As a result, production cost may be held low with a limited number of production tools, while assembly and installation may be conveniently performed.

The terminal **10** operates by increasing the cross-section of its outlet opening dependent on the level of airflow provided through the terminal **10**. This is accomplished by the flaps **14** pivoting under influence of the airflow through the terminal **10**, such that the slit **16** has a width which is self-adjusted to increase with the airflow. This is illustrated in FIG. **2**, in which a higher airflow (illustrated by fatter arrows) is provided to the terminal **10**. The flaps have then pivoted outwardly in the aperture **13**, such that the slit **16** has increased considerably.

The described configuration of the terminal **10**, where a small slit opening **16** is maintained for low flows, means that a comparatively high flow velocity out from the terminal **10** may nevertheless be accomplished in a ceiling **4** installation of a room. Furthermore, since the deflector **12** is connected at a distance or spacing **121** from the wall member **11**, air will be ejected substantially horizontally out from the aperture **13** to spread along the ceiling **4**, where it will conveniently mix with the air present in the room.

By means hinging the flaps **14** to the wall member **11** of the terminal **10**, surrounding its opening **110**, the slit opening will open up to a funnel shape for higher flows, as seen in FIG. **2**. This way, generation of noise is minimized since the airflow will not primarily be throttled over an edge. At lower flows, when the flaps **14** hang down as in FIG. **1**, noise generation will nevertheless not be a problem due to the comparatively low velocity of the airflow.

In a preferred embodiment, the flaps **14** are pivotable between the relaxed position as shown in FIG. **1** and a high flow position, and may preferably assume any position at least there between. In the relaxed position the flap edges **142** are preferably arranged radially inwardly of a perimeter **121** of the deflector **12**, as shown in FIG. **1**, at a first distance from the deflector representing the minimum slit opening **16**. This may e.g. be accomplished by arranging the hinges **15** radially inwardly of the perimeter **121** of the deflector. By this arrangement, a flat outer portion **122** of the deflector within the perimeter **121**, facing the opening **110**, may also assist in guiding low level airflow in a horizontal direction out from the slit opening **16**, rather than falling down, towards the surrounding ceiling **4**.

In the high flow position as shown in FIG. **2**, the terminal **10** may be configured such that the flap edges **142** are arranged radially outwardly of the perimeter **121** of the deflector **12**. In an alternative embodiment (not shown) the deflector **12** may extend even further outwardly, such that its perimeter **121** is always arranged outwardly of the flap edges **142**, even at high airflow.

In various embodiment, including the ones shown in the drawings, the supply air terminal **10** may be configured with an outwards projecting flange **111**, formed at an outer end of the wall member **11**, which flange **111** extends in a plane about the opening **110**. The flange **111** may conveniently be configured for ceiling **4** mounting, wherein an upper side of the flange **111** forms a ceiling abutment.

As noted above, but which is more clearly seen in e.g. FIG. **4**A, the outer portion **122** of the deflector **122** is preferably parallel to, and spaced apart outwardly of, the projecting flange **111** by a distance **121**. Such an arrangement, where outer portion **122** of the deflector **12** and the flange **111** of the wall member **11** form spaced apart parallel surfaces, will assist in guiding air towards and along the ceiling **4** surrounding the terminal **10**. The spacing **121** need in fact not be very large to obtain this benefit. A spacing of up to 20 mm, such as 5-15 mm, may be arranged to accomplish this guiding effect while still being substantially unnoticeable for persons in the room.

Tests on a terminal configured according to FIGS. **1-5** have shown that even at airflows of cool air as low as 4 l/s, the air will be ejected though the slit **16** in the rested position, and propelled along the ceiling to mix with the surrounding air that will be drawn up by the kinetic of the inlet air and heat the fresh air. Already about 1.5 m from the terminal **10** along the ceiling **4**, inlet air at a temperature of 15 degrees has been heated to 21 degrees in an ambient atmosphere of 22 degrees.

The opening **110** formed by the wall member **11** preferably has a cross-section which increases from a position of the hinge **15** towards the projecting flange **111**. This allows room for the hinges to pivot outwardly. In the drawings, the wall member **11** is angled to accomplish this increasing cross-section, e.g. by 30 degrees from horizontal. Since the flaps **14** form the outer perimeter of the opening through which air is ejected, the particular shape of the wall member **11** may be different than the straight wall funnel shape of the drawings for various alternative embodiments.

Turning to FIGS. **5**A and B, which conveniently show enlarged portions of an embodiment of the terminal **10** from a perspective view, it may be seen that each flap **14** extends in a first direction from the hinge **15** to the flap edge **141**, i.e. downwardly in the rested position of the flap **14**. Furthermore, a balancing portion **142** may be connected to the flap **14**, extending in a second direction from the hinge **15** to calibrate the position of center of gravity for the flap **14** with respect to the position of the hinge **15**. This may be provided to minimize or calibrate the required rotation force for pivoting the flap **14**. Dependent on which levels of airflow the terminal **10** is to be used for in a certain installation, a flap **14** of selected character in terms of size but also balance point may be selected and hinged to the wall member **11**. Furthermore, the balancing portion **142** may be conveniently cut off to a selected degree, or be provided with an added weight e.g. by clamping or gluing, so recalibrate the point of balance of the flap **14**. In one embodiment, the balancing portion **142** is an extension of the flap from a position of the hinge in a direction opposite to the flap edge **141**. In such an embodiment, the flaps may be provided with a hinge aperture **151** at between 55 and 70% of the height of the flap, such as at 60% of the height.

In one embodiment, the hinge **15** comprises an aperture **151** formed in the flap **14** and a hinge member **152** projecting from the wall member **11** into the aperture **151**. The flap is thereby suspended by resting with an edge of the aperture **151** against the projecting hinge member **152**. This means that there will be a very small point of contact between the flap **14** and the wall member **11**, which will assist in minimizing the required force for pivoting the flap **14**.

In the exemplary embodiment of FIGS. **5**A and **5**B, the hinge member **152** is a bent portion extending from the wall member **11**. This provides a very simple solution, that may be accomplished by cutting and bending of a metal sheet. In the illustrated embodiment, the hinge **15** is formed by a substantially horizontal aperture **151** and a horizontal hinge member **152**. For the purpose of further minimizing the point of contact between the flap **14** and the wall member **11** at the hinge **15**, the hinge member **152** may e.g. be a sheet member projecting from the wall member **11**, bent or twisted to assume a substantially vertical shape. That way, the point of contact in the hinge **15** will be an edge of the bent or twisted portion **152**, and an edge of a corresponding vertical aperture **151** in the flap **14**.

The terminal **10** as exemplified by embodiments herein is configured to be produced at low cost. In a preferred embodiment, the wall member **11** and the flange **111** are formed from a single sheet of metal, such as steel or aluminum. This means that with simple cutting and bending operations, the major part of the terminal **10** may be produced from a single element, at low production cost and high speed. Preferably also the hinge member **152** is formed from the same single sheet of metal. Each flap **14** may in one embodiment be provided by means of a flat element, such as a sheet of plastic or metal. It needs only cutting or molding to the desired shape and to form the hinge apertures **151**. In an embodiment configured as shown in FIGS. **5**A and **5**B, where each flap **14** is hinged to a pair of hinge member **152**, which are notched at facing edges, a flexible flap **14** of e.g. plastic may be bent to fit the hinge members **152** into the apertures **151**, where after the flap **14** will flex back and be securely attached at the hinge as shown in FIGS. **5**A and **5**B.

In one embodiment, the wall member **11** may be configured with slanting portions as illustrated in the drawings. This may be accomplished by pressing out the shape from a flat metal sheet. In an alternative embodiment, slots **112** may be formed at corner positions, as can be seen e.g. in FIG. **3**A, after which the wall members may be bent to form slanting portions. In one version of such an embodiment, a corner member **17** may be attached to cover the slot **112**. This is depicted e.g. in FIGS. **4**B and **5**A. The corner element may be a metal or plastic member, e.g. attached by gluing to the wall member **11**. The drawings illustrate a corner member **17** attached on the upper, i.e. outer, side of the slanted wall member **11**, but a corner member **17** may alternatively or additionally be provided on the lower, i.e. inner, side of the wall member **11**.

The deflector **12** preferably has a flat outer portion **122**, and preferably also a flat lower side so as to accommodate well to the surface of the ceiling **4**. In one embodiment, the deflector **12** may be configured as a flat sheet of e.g. metal or plastic, which, is detachably connectable to the wall member **11**. This may e.g. be obtained by means of latches or screws (not shown). In one embodiment, magnets are employed for attaching the deflector to the wall member **11** of the terminal **10**. In the exemplary embodiment of FIGS. **4**B and **4**C, a magnet **171** may be attached to the corner member **17**, which corner member **17** is shaped to attach the deflector at the appropriate distance **121** from the wall member **11**. In an embodiment where the deflector **12** is made of steel, magnets **171** provided at the corner members **171** may attached directly to an upper surface of the deflector. For a plastic embodiment, a magnetic attachment member may be attached to a predetermined position of the upper side of the deflector **12**.

In various embodiments, a control unit **20** comprising electronics for e.g. processing or measuring airflow, temperature or other parameters, and potentially controlling an air valve (not shown) in the box **2**, may be provided at the upper side of the deflector **12**. This way it may be readily accessible for communication or maintenance. However, the deflector **12** does not in itself carry any parts related to the pivotable flaps **14**. This means that a substantially smooth upper surface of the deflector **12** may be provided, which contributes to keeping a low noise level even at high airflows, and also prevents collection of dust.

The terminal **10** may take any shape, in terms of the cross-section of the opening **110**. In the embodiments shown in FIGS. **3**-**5**, the wall member **11** has two pairs of opposing wall sides, providing a rectangular shape to the opening **110**. In such an embodiment, the terminal comprises four flaps **14** hinged to respective wall sides. In an alternative embodiment, the cross-section may e.g. be octagonal. FIG. **6** schematically illustrates parts of another embodiment of a terminal **10**, configured with a cylindrical wall side, providing a circular shape to the opening **110**. The terminal **10** may thus comprises three or more flaps **14**, e.g. twelve flaps **14** as in the illustrated embodiment, connected by hinges **15** to the wall side at evenly distributed positions around the opening **110**. In such an embodiment, adjacent flaps **14** may be spaced apart about the periphery of the wall member **11**, or otherwise configured to partly overlap as they pivot under influence of the airflow through the terminal **10**.

FIGS. **7**-**9** illustrate an air supply system comprising a sealed box **2** connected to a supply air terminal **10**, which terminal **10** may be configured according to any of the embodiments presented herein. The function of the supply air terminal is to provide suitable provision of air to a connecting room dependent on the airflow level provided to the terminal. A supply duct of a ventilation system may connect to the box **2** at an interface of an inlet opening **3** provided in a first wall **21** of the box **2**. The box **2** has an opening **71** in a second wall **22** at its lower side, substantially perpendicular to the first wall **21**, to which opening **71** the supply air terminal **10** is connected. A valve device for regulation of the airflow (not shown) may be arranged in the box **2**, for regulating the airflow provided to the terminal **10**, or otherwise in the duct system connecting to the box inlet opening **3**.

The flaps **14** of the supply air terminal **10** are configured to prevent cool air from falling down from the terminal, by self-adjustment of the opening slit under the flaps. In various embodiments, the flaps **14** may also be used for reducing the air velocity in a certain direction, when two adjacent terminals **10** eject air towards each other. In such circumstances, the opposing flaps may e.g. be adapted by applying weights to the flaps **14**, or by cutting the flaps.

Especially at larger air flows, it is important that an even air distribution is achieved in different directions, preferably all directions. Otherwise, collision of air from different terminals **10** may occur, designing ventilation systems will be greatly impaired. In a supply air system of FIGS. **7**-**9**, air will typically flow into the box **2** through one side wall **21**, for subsequent ejection through the lower wall **22**. This may cause air to distribute unevenly. However, by careful design of the outlet opening **71** in the box **2**, at which the terminal **10** is attached, substantial improvement has been obtained in terms of even distribution. The shape of the outlet opening **71** is formed to advantageously limit the area of the outlet. This shape may be obtained by providing flanges to side walls of the box **2**, or by cutting out a preferred shape of the outlet opening **71** in a bottom wall of a box **2**.

In a preferred embodiment, the outlet opening **71** runs between the first wall in which the inlet **3** is disposed, and an opposing wall **23**. Moreover, the outlet opening **71** is as widest at a central part of the second wall **22** and narrows towards said first wall **21** and said third wall **23**. Preferably, the contour of the outlet opening **71** arcs between the first wall **21** and the facing third wall **23**.

In various embodiments, test have shown that further improved even distribution is obtained where the outlet opening **71** has smaller width at the opposing wall **23** than at the inlet wall **21**. The outlet opening may have a first width W**1** at the first wall **21**, a second width W**2** at a central part of the second wall **22**, and a third width W**3** at the third wall **23** facing the first wall, wherein said first width W**1** is larger than said first third width W**3**. The second width W**2** is larger than both the first width W**1** and the third width W**3**.

Various embodiments have been presented and discussed above. It shall also be understood that features of those embodiments may be combined, where not contradicting. Th general design of the terminal, which provides an adjustable flap **14** that is not closed in its most restricting position, means that there is little risk for building up dirt at the surfaces of and surrounding the flap, and that there is substantially no risk for the flap **14** to get stuck in a certain position.

The embodiments shown are primarily configured for mounting at a ceiling **4**. In one embodiment, one or more terminals **10** provided in a ceiling **4** may risk to eject air towards each other, if they are situated to close to each other or another object such as a wall. The result may be that cool air that has not yet been heated by mixing with the ambient air can be forced downwards into the room, causing a disadvantageous draught. In such a situation, one or potentially more flaps **14** may be locked in a vertical position, corresponding to the position of FIG. **1**. This will restrict the airflow in that direction, to as to avoid the mentioned draught situation. Since only one flap **14** is locked, or maybe two flaps **14**, out of e.g. four flaps **14** present in the illustrated embodiment, this will not lead to a high velocity ejection of air through the small slit **16** of the locked flap(s). Instead, the air will take the easiest way out through the remaining flaps **14** that are still pivotable.

Although the embodiments described herein are arranged for ceiling mounting, it should be understood that a supply air terminal as provided herein may alternatively be configured for mounting in a wall, preferably for ejecting air along a ceiling portion from the wall, and in such an embodiment the aperture may be configured as a straight slot rather than annular aperture. In addition, other embodiment falling within the scope of the appended claims will be conceivable based on the teachings of this disclosure.

The invention claimed is:

1. A supply air terminal for ceiling mounting, comprising a wall member surrounding an opening for connection to an air supply interface in the ceiling; a deflector connected at a distance from the wall member to face the opening, thereby forming an annular aperture between the wall member and the deflector, the deflector comprising a flat outer portion extending parallel to the ceiling; a plurality of flaps pivotably connected at a hinge to the wall member to hang down in the annular aperture such that an open slit is formed between an edge of each flap and the flat outer portion of the deflector, wherein the slits have a width which is self-adjusted by means of the flaps pivoting between a relaxed position and a high flow position under influence of the airflow through the terminal, and a minimum width of each slit is in a range of 5-20 mm when the flaps are in the relaxed position, and wherein air is always passing through the slit.

2. The supply air terminal of claim **1**, wherein the flap edges are arranged radially inwardly of a perimeter of the deflector and at a first distance from the flat outer portion of the deflector in at least the relaxed position.

3. The supply air terminal of claim **2**, wherein the flap edges are arranged radially outwardly of the perimeter of the deflector in the high flow position.

4. The supply air terminal of claim **1**, wherein an outwards projecting flange is formed at an outer end of the wall member, which flange extends in a plane about the opening.

5. The supply air terminal of claim **4**, wherein the flat outer portion of the deflector is parallel to and spaced apart vertically from the projecting flange.

6. The supply air terminal of claim **5**, wherein the wall member and the flange are formed from a single sheet of metal.

7. The supply air terminal of claim **6**, wherein said hinge comprises an aperture formed in the flap and a hinge member projecting from the wall member into the aperture, such that the flaps rests with an edge of the aperture against the projecting hinge member, and wherein said hinge member is formed from said single sheet of metal.

8. The supply air terminal of claim **7**, wherein said hinge member is a bent portion extending from the wall member.

9. The supply air terminal of claim **4**, wherein the opening formed by the wall member has a cross-section which increases from a position of said hinge towards said projecting flange.

10. The supply air terminal of claim **1**, wherein each flap has a balancing portion for calibrating the position of center of gravity for the flap with respect to the position of the hinge.

11. The supply air terminal of claim **1**, wherein said wall member has two pairs of opposing wall sides, providing a rectangular shape to the opening, the terminal comprising four flaps hinged to respective wall sides.

12. The supply air terminal of claim **1**, wherein said wall member has a cylindrical wall side, providing a circular shape to the opening, the terminal comprising three or more flaps hinged to the wall side at evenly distributed positions around the opening.

13. The supply air terminal of claim **1**, wherein said deflector is a flat sheet, detachably connectable to the wall member.

14. The supply air terminal of claim **1**, wherein each flap is made from a flat sheet of plastic.

15. The supply air terminal of claim **1**, wherein the flat outer portion of the deflector extends to the perimeter of the deflector.

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